be said to have been verified with an accuracy of one part in a million.

The certificate of the verification of the end standard, or *mètre-à-bout* (étalon No. 6), will not be issued by the Committee until their general conference in September next; but this standard has been verified also with great accuracy, with a probable error of ± 0·3μ. In the verification of the end standard (*mètre-à-bout*) MM. Cornu and Benôit have introduced a method of reflection, by means of which it is unnecessary to bring the ends of the metre bar into contact with any touching surfaces, and thus the measuring ends of the bar may be carefully preserved and used. Only Austro-Hungary, Germany, Great Britain, and Russia have at present applied to the International Committee to be supplied with *end* standard metres.

Experiments with reference to light-wave analysis, which have been carried out under the directions of the International Committee by Dr. Michelson during 1893, with the view to the discovery of a radiation of light of sufficient homogeneity to serve as an ultimate standard of length, appear to show that it is possible within certain limits to reproduce the length of the metre by reference to such physical constant.

The Kilogramme.

The unit of mass of the kilogramme is determined by a piece of iridio-platinum in the form of a cylinder, the height and diameter of which are equal (thirty-nine millimetres). The kilogramme, No. 18, supplied to Great Britain has no distinguishing marks, and is highly polished. On analysis it showed very faint traces of ruthenium, rhodium, and iron. Its volume was found to be at 0° C.

Prototype 18 = 46·414 millilitres,

corresponding to a density of—

21·5454.

After its final adjustment it was found to be *in vacuo* at 0° C.

Prototype 18 = 1 kg. + 0·070 ± 0·002 milligramme.

So that it may be said that the kilogramme (kg.) has been verified with a probable accuracy of 0·002 parts in a million.

NOTES.

THE Committee of the Athenæum Club, acting under the Rule which provides for the annual election of persons "of distinguished eminence in science, literature, the arts, or for public services," have admitted to membership Prof. Bayley Balfour, F.R.S., and Sir W. H. White, K.C.B., F.R.S.

DR. F. J. LAUTH, the eminent Egyptologist, died at Munich on the 11th inst., at the age of seventy-three. He was Honorary Professor of Egyptology at the University of Munich, and Keeper of the Egyptian Collections. His writings on the antiquities of Egypt are numerous and important.

WE regret to announce the death of Prof. Heinrich Wild, of St. Petersburg. He was a Swiss by birth, and his work in magnetism and optics, as well as the magnetometer, polaristrobometer, and other instruments devised by him, are well known to students of physics.

IT is reported from Athens that the architect who has examined a number of the ancient monuments in Athens, states that the majority of them, and particularly the Parthenon and the Temple of Theseus, are in a dangerous state. The work of rendering them secure would cost a million drachmas. The Archæological Society intends to make an appeal to all countries for a portion of the money required to restore these wonderful monuments to a sound condition.

GENERAL ANNENKOFF, constructor of the Russian Central Asian Railway, has been appointed one of the vice-presidents of the International Congress of Geography to be held in London in July next. Russia will further be represented on that occasion by nine or ten other well-known men, including Senator Semenoff (vice-president of the Imperial Russian Geographical Society), M. Grigorieff (secretary of the same society), and Baron Wrangel (director of the Imperial Lyceum).

A REUTER telegram from St. Petersburg reports that a scientific expedition, organised by the French Minister of Public Works, has just arrived at Samarcand. The head of the expedition is M. Jean Chaffanjon, who has previously made a journey in South America, and he is accompanied by two naturalists, MM. Henri Mangine and Louis Gay. From Samarcand the expedition will proceed to Tashkend, and after completing all the necessary preparations there, will start on a journey of exploration in Tibet and other countries.

WE are informed by the trustees of the Australian Museum, Sydney, that Dr. E. P. Ramsay, after twenty years' service as Curator of this Museum, has retired, owing to ill-health. Dr. Ramsay's official connection with the Museum as Curator ceased from December 31, 1894. The trustees have appointed as his successor Mr. R. Etheridge, jun., formerly of the British Museum, and lately Palæontologist to this Museum, and to the Department of Mines of New South Wales, and who has on several occasions temporarily acted as Curator. Mr. Etheridge has entered on the duties of Curator.

DR. A. R. WILLIS will commence a course of six lectures to working men at the Museum of Practical Geology, Jermyn Street, on Monday, March 4. The subject of the course is "Heat Engines."

THE weather over these islands has been comparatively mild during the past week, and the higher temperatures which set in at the end of the prolonged frost were maintained for some days; subsequently there was a slight return of cold, with high barometric pressure, accompanied by strong north-easterly winds, and snow showers in various places. Frost occurred on Sunday and following nights, the lowest shade temperatures being 22° in the central parts of Ireland, while in the south-eastern and midland portions of England the readings were several degrees below the freezing point.

AT a recent meeting of the Vienna Academy of Sciences, the President announced that the late Herr Joseph Treith, director of the First Austrian Savings Bank, had bequeathed the whole of his considerable fortune to the Academy for the purpose of the advancement of science. The grants are to be apportioned by a committee of five, three of whom are to be appointed by the Academy, and two by the Minister of Education, the Academy to decide all doubtful questions. The branches of science to be encouraged are those for which there is no other official provision made. Among the subjects suggested are the physical structure of the earth and of the heavenly bodies. The income is to be divided every year into several grants, but if some great enterprise is to be undertaken, it shall be permitted to let the funds accumulate for not more than three years. The extension of higher instruction among all classes fitted for it by education, the strengthening of moral character, the advancement of technical education, the simplification of medical practice, and the furtherance of the material prosperity of the human race by invention and discovery, are the guiding principles indicated by the donor for the administration of his generous gift.

AT the last meeting of the Société Française de Navigation Aérienne, M. de Fonvielle gave an account of a paper by M. Andrée, the chief engineer of the Swedish Patent Office, read on the 14th inst. before the Stockholm Academy of Sciences. In that paper the Swedish aëronaut described a scheme to go to the North Pole in a balloon, and, to carry out his plans, he asked for a sum equivalent to about £7220. Although M. Fonvielle opposed a similar scheme put forward about seven years ago by two of his countrymen, he expressed himself favourable to the new undertaking, and his opinion seemed to have been shared by the Society. M. Andrée has already executed a number of ascents in very difficult circumstances. He is well acquainted with all the peculiarities of Arctic climates, having been one of the meteorologists of the Swedish 1882-83 expedition for observing the transit of Venus from Cape Thorsden. He hopes to start from this station in the month of July, 1896, as it appears that there are no great variations of temperature at that time of year. The balloon is to contain 186,000 cubic feet of gas, and the inflation process is to be carried out at Cape Thorsden by means of compressed hydrogen.

THE Select Committee of the House of Commons appointed to inquire into the existing systems of weights and measures in this country had a meeting on Tuesday, under the presidency of Sir Henry Roscoe. Evidence was given by Mr. H. J. Chaney, Superintendent of the Standards Department of the Board of Trade, who described the system under which the verification of legal standards is carried on at the Board of Trade by experts appointed for the purpose, and also gave an account of the different systems of weights and measures now in use in the United Kingdom. He stated that the Imperial and the metric systems were the only ones with which the Department had to do in England, but there were other local customary weights and measures in use. There were many weights and measures in use which were not legally recognised. Among these he mentioned the carat, the boll (used in Scotland), the ell, the coomb (used for measuring corn), the Winchester bushel, the butchers' stone of 8 lb., the miners' dish (used for weighing ore in Derbyshire), and the gauge (used in measuring plates) as examples of weights and measures which were not recognised by law. A number of anomalies which formerly existed—*e.g.* a ton of stone being different from a ton of other materials, &c.—had disappeared to a great extent under the operation of the Weights and Measures Acts of 1878 and 1889. The Scotch and Irish mile were still locally recognised, but for all statutory purposes a mile was 1760 yards. Practically the only two countries of any importance in Europe in which the metric system was not adopted were Great Britain and Russia. In Germany, Austria, France, Italy, Spain, and Portugal the metric system was the only system in use.

DURING recent years the advantages of work at biological stations have been recognised at various Universities. The Indiana University has lately shown its appreciation of the need for such research by deciding upon the establishment of an inland biological station on one of the lakes of Northern Indiana, probably Maxinkuckee. To begin with, the main object of the Station will be the study of variation. For this purpose it was thought that a small lake would present a limited, well circumscribed locality, within which the differences of environmental influences would be reduced to a minimum. The study will consist in the determination of the extent of variation in the non-migratory vertebrates, the kind of variation whether continuous or discontinuous, the quantitative variation, and the direction of variation. In this way it is hoped to survey a base line which can be utilised in studying the variation of the same species throughout their distribution. This study should be carried on for a series of years, or at least be repeated at definite intervals to determine the annual or periodic variation from the mean. A comparison of this variation in the same animals in other similarly limited and well-circumscribed areas, and the correlation of the variation of a number of species in these areas, will demonstrate the influence of the changed environment, and will be a simple, inexpensive substitute for much expensive experimental work. In connection with this study of the developed forms the variation in the development itself will receive attention; for instance, the variation in segmentation, the frequency of such variation, and the relation of such variation in the development to the variation in the adult, and the mechanical causes affecting variation. Admirable courses of instruction have been drawn up by Prof. Carl H. Eigenmann, the Director of the Station, to lead to the special investigations, and there is every indication that useful work will be accomplished.

DR. A. PETER gives, in the *Nachrichten von der Königlichen Gesellschaft der Wissenschaften zu Göttingen*, the results of a second series of cultural experiments with dormant seeds, taken from various depths in the soil of woodlands or forest. The forest in question of the present day is the site of villages and cultivation that disappeared several centuries ago; and some of the samples were taken from dense forest, 100 to 150 years old, under the shade of which there has been no surface vegetation for years. The principal point to investigate was the probable existence of seeds of cornfield weeds still possessing the power of germinating and developing into reproductive plants. Dr. Peters succeeded in raising a large number of plants belonging to about fifty different species, including some that are essentially weeds of cultivation; and he believes he has good grounds for supposing that the buried seeds of many pasture plants and cornfield weeds retain the vitality much more than half a century; that is, under the conditions he describes.

THE hundreds of Gulls that have lately come up the Thames in search of food seem only matched by a remarkable invasion of the north and north-east coasts, by the Little Auk (*Mergulus alle*) during January. Writing in the *Zoologist*, Mr. J. E. Harting says that on the 21st of that month, great numbers were observed passing south, both at sea and along the coast, and many were cast ashore in a helpless condition, exhausted in their attempts to withstand the stormy weather which has recently prevailed. In the neighbourhood of Redcar, as many as two hundred and fifty of these little birds have been counted; at Scarborough they were also numerous, and on the Norfolk coast one hundred and twenty have been captured. Another result of the severe weather and snow during the third week in January, was that the Grouse in Yorkshire left the moors in packs, and migrated to the lower grounds in search of food and shelter. It is pointed out that an exodus of this kind is of extremely rare occurrence; the last one being during the severe winter of 1886.

IN the *Meteorologische Zeitschrift* for December last, Prof. G. Hellmann gives a very interesting account of the invention of the barometer which has now been in use 250 years. Torricelli, who died at the early age of thirty-nine years, was too busily engaged in mathematical studies to publish an account of his discovery, but on June 11, 1644, he wrote a description of it to his friend Ricci. This letter, and Ricci's objections to the experiment, were published in 1663 by C. Dati, a friend of Torricelli's, and as this work is now exceedingly scarce, Prof. Hellmann has reprinted the correspondence, in the original Italian, in the above-mentioned journal. Some of the paragraphs are noteworthy, especially those in which Torricelli states that it was not merely a question of producing a vacuum, but of making an instrument which would indicate the changes of the atmosphere. The first continuous barometrical observations appear to have been made in France. In England they were first taken by Robert Boyle, about the year 1659, to whom we owe the invention of the word "barometer."

SOME time ago we gave an account of the considerable extension of the ultra-violet photographic spectrum obtained by Dr. Victor Schumann, of Leipzig, by eliminating the air between the so urce and the sensitive plate, which was found to exert a strong absorption upon the rays of shortest wave-length. This work has been carried on since with great success. At a recent meeting of the Vienna Academy, Dr. Schumann announced that he had improved his plates and his "vacuum spectrograph" so as to obtain results in a few minutes which used to take as many hours. The hydrogen spectrum shows a further lengthening, and the spectra of cobalt, iron, aluminium, zinc, and cadmium have also been considerably extended beyond 170 $\mu\mu$. This limit, although far beyond the ordinary limits of the photographic spectrum, was due to a residue of air and electrode vapour. The absorptive effect of air upon the most refrangible rays was traced down to thicknesses below 0·01 mm. Hydrogen also shows a strong absorption for these extreme rays, especially if insufficiently dried.

HERR K. MACK, working in the Hohenheim Physical Institute, has succeeded in demonstrating the occurrence of double refraction of electric waves in wood. That electric waves, unlike light waves, are capable of penetrating wood, was already found by Hertz. "It is not without surprise," he says in his classical work on the "Propagation of Electric Force," "that one sees the sparks appear inside a closed room." But the fact that waves of electric force are transmitted in a different manner accordingly as they vibrate across or along the fibre of the wood, has only just been proved by Herr Mack, who gives a full description of his method in the current number of *Wiedemann's Annalen*. It is well known that two Nicoll prisms transmit no light when their principal planes are crossed, but that light may be made to appear by inserting a doubly-refracting substance between them. For the Nicoll prisms substitute Hertzian concave mirrors with their focal lines crossed, and, instead of the tourmaline or other doubly-refracting substance, insert a plate of wood 10 inches thick, with its fibre at 45° to each of the focal lines, and you have Mack's apparatus. The sparks, which are extinguished on crossing the two focal lines, reappear on inserting the wood in the manner indicated. This striking experiment forms another important link in the chain connecting the domain of light with that of electricity.

IN an admirable paper on the after-shocks of earthquakes (*Journal* of the College of Science, Imperial University of Japan, vol. vii. part ii.), Mr. F. Omori has attacked a somewhat neglected branch of seismology. In three recent Japanese earthquakes, those of Kumamoto in 1889, Mino-Owari in 1891, and Kagoshima in 1893, the after-shocks have been carefully recorded, and are here specially studied from the frequency point of view. Numerous tables are given, and also many curves showing the way in which the number of after-shocks varies with the time at different places. When their inequalities are smoothed away, these curves differ little from rectangular hyperbolas. At the same time, they show periodic fluctuations in the decrease of frequency of after-shocks. Besides the diurnal and annual fluctuations, six different periods have been ascertained, whose lengths range from a few hours to several months. In the case of the great Mino-Owari earthquake of 1891, the after-shocks were most numerous some distance to the south of the principal epicentral tract, which lay in the Neo valley. They also occurred more frequently along four axial lines, radiating from the vicinity of Koori, than in the neighbouring districts. Mr. Omori suggests that the principal earthquake was caused by the formation of some great fractures beneath the Neo valley, and that the axial lines indicate the positions of four weaker or deeper fractures, along which the crust is not yet in the way of steadily settling into equilibrium.

IN a paper recently published (*Journal of Geology*, May-June 1894; *Johns Hopkins University Circular*, January 1895), Prof. W. K. Brooks discusses from the zoological point of view a problem familiar to the geologist—the sudden appearance in the Lower Cambrian of a rich fauna in which most of the great classes of animals are represented by unmistakable forms. His conclusion is that early Cambrian times and those immediately preceding them formed a period of rapid modification induced by the first colonisation of the sea-bottom. His arguments may be briefly summarised thus:—Embryology indicates simple pelagic forms, as the ancestors of all the great animal stems. The existing pelagic fauna consists in part of small and primitive forms, and in part of the specialised descendants of shore or bottom forms. The fact that the latter are almost exclusively carnivorous indicates the enormous wealth of plant-life, mostly of minute forms, on which ultimately the existence of all the fauna depends, and shows the extremely favourable character of the conditions of pelagic life to simple organisms. The supply of these simple organisms is inexhaustible, and on them the bottom-fauna also depends for food. It is suggested that the evolution of all the main stems of animal life took place at the surface of the ocean, but that when their descendants had colonised the bottom the crowding that soon ensued there led to fierce competition, especially between nearly related forms, and to the specialisation of the types already established, but not the production of new types. The development of hard skeletons was an early result of these conditions. Geologists will certainly find many points to criticise in Prof. Brooks's suggestions, but they constitute an important addition to the discussion of faunal origins.

ONE of the many botanic stations the advancement of which has been promoted by the Director of the Royal Gardens at Kew, is that at Aburi on the Gold Coast. A few interesting facts referring to the establishment and present condition of this station are given in the *Kew Bulletin* for January, from which the following information has been gathered. The site is in the hills, at an elevation of about 1400 feet, overlooking the sea-board, near Accra and Pram Pram. In addition to its suitability for the growth of economic plants, Aburi is a valuable resort for European invalids. The locality has been greatly improved of late years, and it promises to become the centre of activity for many cultural industries started by the Botanic Station. During the winter of 1893–94 Mr. William Crowther, the curator (appointed in 1890), was deputed to visit the West Indies "to observe the system pursued there in the cultivation of economic plants, and to bring back such useful seeds and plants as might with advantage be introduced to the Gold Coast." Mr. Crowther very successfully carried out the object of his mission, and published a detailed report. Since then the work of the Aburi Station has made excellent progress. The inception, as well as the actual work, so far accomplished in botanical enterprise at the Gold Coast, is entirely due to the Governor, Sir W. B. Griffith. He has given warm and consistent support to the station, and personally encouraged in every way the efforts of the curator.

THE *Forschungsberichte* (Theil 3, 1895) of the biological station at Plön, recently published, contains a number of interesting papers on the flora and fauna and on the biological phenomena of the lakes adjoining the station. Among the contents may be mentioned the copious reports on the flora by Drs. Klebahn and Lemmermann, the faunistic contributions of Dr. Zacharias, and the memoirs of Drs. Zacharias and Strodtmann on the Plankton of the lakes. The investigation of the movements, periodicity, and changing quantity of floating organisms in inland waters can be pursued with such ease and completeness, as compared with marine phenomena, that biologists may look forward to the early achievement of valuable results by Dr. Zacharias and his assistants. The present report goes far to justify this expectation.

THE history of the Royal Microscopical Society, as told by Mr. A. D. Michael in his presidential address last month, is contained in the February *Journal* of the Society.

A BOOK of gummed labels, for the chemical laboratory, having the names of 750 special reagents, &c., printed upon them, has been compiled by Mr. W. H. Symons, and published by Messrs. A. Gallenkamp and Co.

WE are always glad to see the Reports of the Natural Science Societies of our Public Schools. The twenty-fifth annual report of the Wellington College Society has just come to hand, and the abstracts of the lectures delivered under the auspices of the Society, as well as the records of observations in various branches of science, show that excellent work is being done in creating and fostering interest in natural knowledge.

MR. H. WARINGTON SMYTH'S "Notes of a Journey on the Upper Mekong, Siam," read before the Royal Geographical Society just a year ago, have been published in a handy and attractive form, for the Society, by Mr. John Murray. Siamese and Laos life are vividly described in the volume, and interesting information is given with regard to the geographical and general features of the country traversed.

THE Society for the Protection of Birds was called into existence to protest against the slaughter of birds for decorative purposes. It now numbers more than eleven thousand members, and the fourth annual report shows that it plays an important part in preventing the extermination of our rarer species of birds. Owing to the Society's efforts, that remnant of primitive ornamentation—the bird-wearing fashion—is on the decline. The Bill passed last July, to amend the Wild Birds' Protection Act of 1880, is given at length in an appendix to the report.

A HANDY work of reference, occupying an intermediate position between a mere school dictionary and a bulky lexicon, is Ogilvie's "Student's English Dictionary," a new edition of which, edited by Dr. C. Annandale, has been published by Messrs. Blackie and Son. The new issue has been so greatly changed and augmented, that it is practically a fresh work. A large number of scientific and technical terms, many of them recently introduced, as well as thousands of other words, have been added. The woodcut illustrations have been more than doubled, there being now nearly eight hundred of them. Experience has taught us that the "Students' Dictionary" rarely disappoints the inquirer; in its improved and enlarged form, it will be even more useful.

MESSRS. MACMILLAN AND CO. will shortly publish an important work on "Meteorology," by Mr. T. Russell. The book has for its main object the explanation of the use of weather-maps for the purpose of making forecasts. The various forms of meteorological instruments are described, and a general view is taken of all knowledge connected with the science of meteorology, and of interest in relation to weather changes. To a large extent, the volume refers to weather prediction in the United States, and to the use of weather-maps in the prediction of floods along the lower Ohio and Mississippi Rivers. It will, however, also appeal to European meteorologists, as well as assist in the development of scientific weather observation and prediction. Another work which will very soon be published by the same firm, is a translation of the late Prof. A. de Quatrefages' "Les Pygmées." This volume, which is the second in the Anthropological Series, has been translated by the editor of the series, Prof. F. Starr, of the University of Chicago.

THE atomic weight of tungsten has been subjected to a careful revision by Prof. E. F. Smith, of the Pennsylvania University, and the specific heat of the pure metal again determined. Two independent series of atomic weight determinations have been carried out, in which Prof. Smith has been assisted, respectively, by Miss M. E. Pennington and Mr. E. D. Desi, and accounts of the work are contributed to the current issue of the *Zeitschrift für Anorganische Chemie.* In the first series the method employed consisted in the reduction of pure tungstic acid to metal in a stream of pure hydrogen, and then determining the amount of oxygen absorbed by the metal upon conversion of the latter into tungstic anhydride by ignition in contact with the air. The mean value of the atomic weight derived from nine such determinations, taking oxygen as 16, is 184·92. The highest and lowest values obtained differed by only 0·02 from this mean value. The second series of determinations were based upon the estimation of the amount of water produced during the reduction of tungstic acid by hydrogen. Exceptional precautions were taken with the purification of the latter, in order to exclude error from this source. The mean of six experiments affords the value 184·70 for the atomic weight of tungsten, the greatest difference between the individual values being only 0·07. The slight difference of 0·2 between the results derived from the two methods of work is probably to be ascribed partly to the difference in the methods, and partly to the different personal factors involved. The mean of the two series, 184·8, may therefore be taken as representing a close approximation to the true atomic weight of tungsten. This value is considerably higher than the currently accepted one, 184·02, the number afforded by Clarke and Becker's recalculation of the experimental results of older determinations. The increase is in all probability due to the great pains which have been taken to remove the last traces of the lighter molybdenum from the tungstic acid employed, a task which is particularly difficult, and which most likely has never previously been so completely achieved.

THE specific heat of the pure tungsten obtained during the course of the atomic weight determinations has been ascertained by Prof. Smith in conjunction with Mr. Grodspeed The method adopted was that described by Joly in 1886, involving the use of the "gravimetric calorimeter." The final mean value arrived at for the specific heat of tungsten 0·0338, a result closely agreeing with former determinations o this constant. The atomic heat obtained by multiplying the new value for the atomic weight by this number expressing the specific heat is 6·25, a value in fairly close accordance with that usually accepted as representing the constant of Dulong and Petit for the truly metallic elements.

The additions to the Zoological Society's Gardens during the past week include a Lion (*Felis leo*, ♂) from India, presented by Her Majesty the Queen; a Black-striped Wallaby (*Halmaturus dorsalis*, ♂) from New South Wales, presented by Miss H. W. Howes; a Hairy-rumped Agouti (*Dasyprocta prymnolopha* from Guiana, presented by Miss W. B. Jackson; a Roseate Cockatoo (*Cacatua roseicopilla*) from Australia, presented by Mr. A. Reynart; four Triangular-spotted Pigeons (*Columba guinea*), two spotted Eagle Owls (*Bubo maculosa*) from South Africa, presented by Mr. J. E. Matcham; a Fieldfare (*Turdus pilaris*) British, presented by Mr. Gervase F. Mathew; two Lions (*Felis leo*, ♂ ♀) from India, deposited; an Eland (*Oreas canna*, ♀), two Collared Fruit Bats (*Cynonycteris collaris*) born in the Gardens.